7 March 2019

GSI ENVIRONMENTAL

MEMORANDUM

TO: Potential Project Stakeholders

FROM: Ann P. Smith, P.E.; Richard L. Bowers, P.E.; GSI Environmental Inc.; Dr. Richard Haut, RPSEA

RE: Request for Participation - *Quantification of Methane Emissions from Marginal (Small Producing) Oil and Gas Wells Project (DOE NETL DE-FE0031702)*

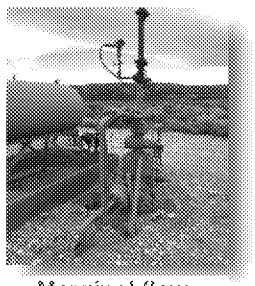
In order to promote fair and appropriate policy making decisions, GSI Environmental Inc. (GSI) is soliciting your participation on an important new study under the U.S. Department of Energy to inform the U.S. EPA and others on the relative scale of methane emissions from marginal vs. non-marginal oil and gas wells.

We are seeking data, access to field sites, supplemental funding and/or technical steering committee participation to ensure that study results are unbiased, representative and appropriate to support recent and future proposed amendments to EPA's New Source Performance Standards (NSPS, 40 CFR Part 60, Subpart OOOOa).

This memorandum summarizes the scope and objectives of our study. Please consider the potential value of this study to all public and private stakeholders, and contact us regarding your questions, concerns and interest in participating.

BACKGROUND

The Environmental Protection Agency (EPA) issued a final rule on June 3rd 2016 (subsequently modified on 11 September 2018) to amend the New Source Performance Standards (NSPS, 40 CFR Part 60, Subpart OOOOa) to reduce methane emissions from new and modified oil and gas facilities. These Standards no longer exempt "low production well sites" (aka marginal or small wells), defined as sites with oil wells that produce <15 bbl per day or gas wells that produce <90 MCF per day, from Leak Detection and Repair (LDAR) requirements. Compliance with these regulations may impact all producers but, in particular, will affect small oil and gas operators of the ~785,000 marginal wells located throughout the United States. EPA's decision to not exclude marginal wells was based on limited methane emissions data. Therefore, a robust unbiased study is needed to quantify methane emissions from non-marginal wells.



Marginal (low producing) gas well in Clay Basin, UT

On 22 October 2018, the Department of Energy – National Energy Technology Laboratory (DOE NETL) selected GSI to perform the proposed study: *Quantification of Methane Emissions from Marginal (Small Producing) Oil and Gas Wells*. The goal is to collect and evaluate representative, defensible and repeatable data from marginal well sites and draw quantifiable conclusions on the extent of emissions from marginal wells across oil and gas producing regions of the U.S.

OVERALL PROJECT PLAN

The project will be completed over ~16 months. Up to three basins, depending on funding availability, will be measured during this study. The project includes the following major tasks:

- robust data source assessment to identify critical data gaps;
- Master Workplan to specifically address key data gaps and, accordingly, direct the overall approach of the field data collection, evaluation and reporting process;
- field campaigns in up to three major U.S. region/basins (Regions A/B/C);
- data processing and analysis; and
- Comprehensive Project Report to summarize study activities, results and conclusions.

DATA SOURCE ASSESSMENT AND MASTER WORKPLAN

A robust data source assessment will be completed to address key data gaps and improve understanding of marginal and non-marginal well methane emissions. Key subtasks include:

- Literature survey of published, peer-reviewed scientific articles to assess quantity, quality, representativeness and usability of data from previous studies;
- *Blind* survey of oil and gas producing companies on key site characteristics, metrics and (optional) activity data (*i.e., names of industry participants, locations of sites and site characteristics will remain confidential and will not be provided to anyone outside of the GSI project team*);
- Development of GIS-linked/enabled database of usable data from literature and operator survey;
- Identification of gaps in current understanding of emissions from marginal vs. non-marginal wells.

Specific data we will obtain from oil and gas marginal and non-marginal well facilities includes:

- General location information (site names, identification numbers, County, State and Basin location, Well type (e.g., natural gas, oil))
- Well condition (e.g., storage, injection, producing, shut-in, plugged, abandoned)
- Equipment types and counts (e.g., wells, separators, compressors, storage tanks, dehydrators, flares, thermal conductors)
- Equipment characteristics (e.g., age, size)
- Production rate (e.g., bbls of oil, MCF gas)
- Existing emissions control devices (e.g., vapor recovery units, flares, enclosed combustion devices)

The results of this assessment will support development of a Master Workplan for the remainder of the study to formulate scientific questions to be answered, refine project objectives/scope, if needed, and identify emissions source characterization/classification criteria, site selection criteria, emissions screening and measurement technology options and selection criteria, to establish appropriate levels of accuracy, representativeness and statistical power of data among different regions.

Critical Outcome/Action/Deliverable: *Identification of specific scientific questions to be answered, and/or hypotheses to be tested, during highly focused field investigations. Report combining data source assessment and Master Workplan. Technical steering committee calls with stakeholders to communicate results and solicit feedback.*

SITE/TECHNOLOGY SELECTION AND FIELD CAMPAIGN WORKPLAN – REGIONS A/B/C

Depending on funding availability, this study will conduct statistically relevant and robust field campaigns in up to three (3) separate regions/basins such that region-wide marginal well counts and emissions profiles can be estimated and compared on a regional basis. Study results will be further extrapolated to estimate emissions from marginal well sites in other oil and gas producing regions/basins not included in this study, and for direct comparison to published emission estimates for marginal and non-marginal well sites across the U.S.

Populations of desirable/candidate regions/basins (e.g., Permian, Appalachian, Uintah) will be identified based on operator survey results, geographic factors and other available information, such as publically-available well production data, and screened for selection. GIS algorithms will be used to optimize field site selection, based on criteria established in prior tasks, relevant candidate site attributes (e.g., numbers/types of emission sources), and applicable time and geographic constraints (e.g., geographic distribution, and travel times from site to site,) and to minimize any potential bias.

Critical Outcome/Action/Deliverable: *Region-specific data collection and analysis protocols, health and safety and QAQC plans. Meeting with site owner/operator representatives (via Regional steering committees) and other stakeholder advisory groups, as necessary, to review results and proposed activities.*

FIELD CAMPAIGN - REGIONS A/B/C

Field campaigns will occur in multiple regionally diverse basins or plays and will include two major components: i) a source survey to characterize the nature and frequency of key emission sources at a representative sample of well sites, and ii) a comprehensive emissions measurement program to quantify emissions from sufficient numbers of representative emitting sources. The results of these efforts will be extrapolated to estimate region-wide emissions utilizing statistically defensible analyses. The key to this approach is the focused, *statistically-based* selection of *representative* field sites to be included for screening and measurement.

During each regional field campaign, which will last up to five weeks, emissions from all pertinent emission sources (e.g., wellheads, major equipment components, storage tanks and, if possible, episodic events such as liquids unloadings based on operator-provided information) will be screened for observed emissions, comparable to what is performed for a regulatory-driven LDAR program. A minimum of 100 marginal and 10 non-marginal well sites and, as practicable, up to a total of 200 well sites will be investigated. Actual numbers of marginal and non-marginal well sites where emissions are screened/characterized vs. measured/quantified will be dictated by the specific technologies employed, the distances among target well site locations, and other possible factors, which may vary by site/region.

Critical Outcome/Action/Deliverable: *Emissions screening and measurement data from representative populations of marginal vs. non-marginal wells sites in each region.*

DATA PROCESSING AND ANALYSIS – REGIONS A/B/C

All collected field data will be compiled and validated per applicable quality assurance/quality control (QA/QC) procedures to assess its usability for further analysis in the estimation of representative emissions estimates for each type of well site. Depending on the needs of the study, data will be grouped into related clusters, statistical probability distributions will be determined, and appropriate statistics (e.g., 95% confidence intervals) will be calculated using

standard parametric or nonparametric procedures in order estimate equipment or process-specific and/or total methane emission rates from observed operations and activities.

Critical Outcome/Action/Deliverable: *Characterization of region-wide frequency and magnitude of marginal vs. non-marginal wellsite emissions. Technical steering committee calls with stakeholders to communicate results and solicit feedback.*

COMPREHENSIVE PROJECT REPORT

The combined study results over all investigated regions (A, B, and C), including operator-provided activity data, frequency of emissions from key sources, and the magnitude of such emissions based on measurements collected at representative fractions of each type of emitting source, will be analyzed and interpreted, as a whole, to assess possible regional differences and, if feasible, make predictions regarding marginal vs. non-marginal well site emissions in other oil and gas producing regions not included in this study.

Critical Outcome/Action/Deliverable: *Draft report summarizing and comparing emissions among significant marginal and non-marginal well site populations in all regions. Meeting with site owner/operator representatives (via Regional steering committees) to review methane emission results and sources.*

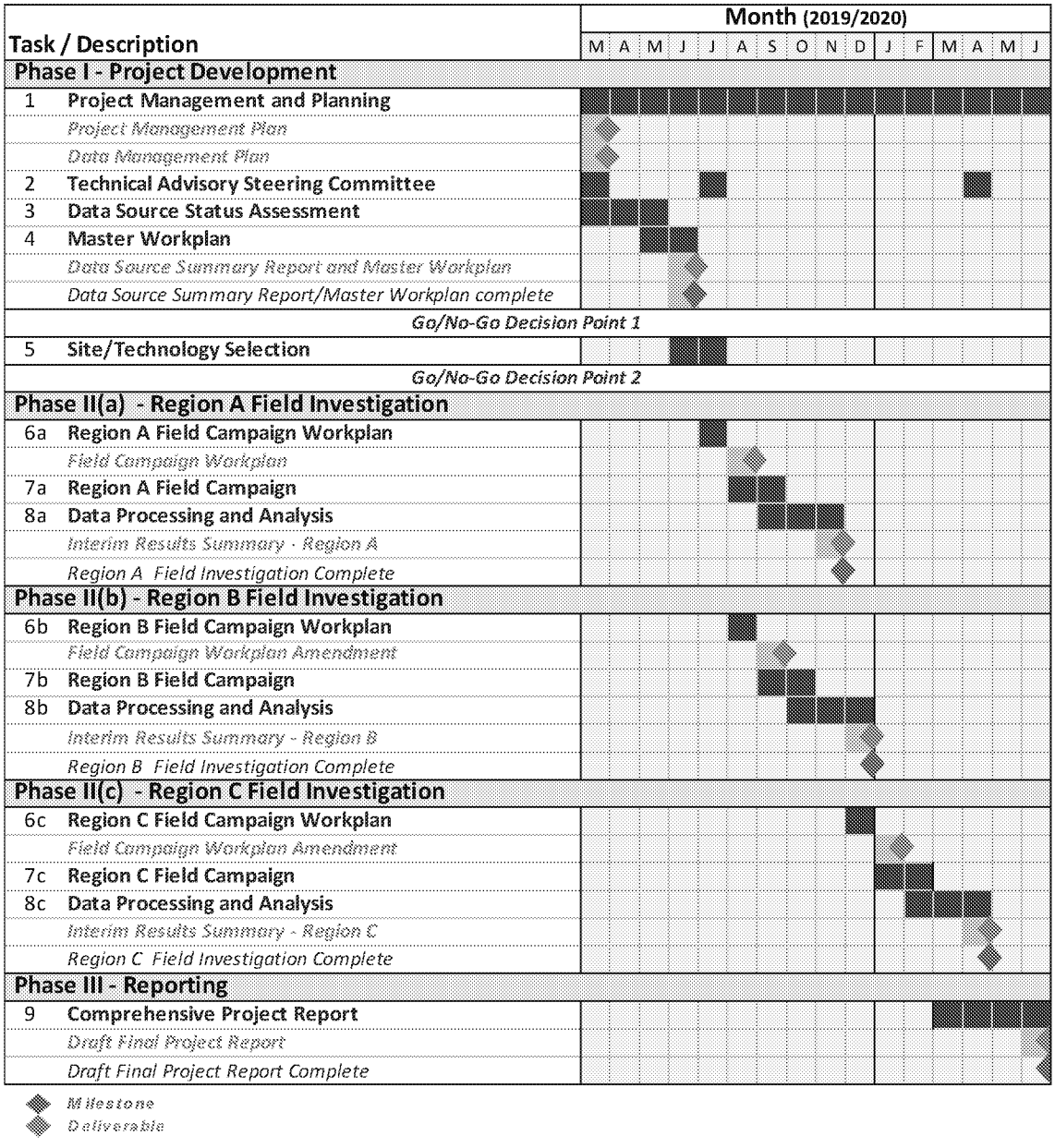
SUPPLEMENTAL FUNDING

As mentioned above, GSI is requesting data, access to field sites, supplemental funding and/or technical steering committee participation to produce study results that are unbiased and representative of methane emissions from marginal and non-marginal oil and gas wells.

PROJECT SCHEDULE

The project is being funded by DOE-NETL to investigate up to three regions, depending on funding availability, over a duration of ~16 months in accordance with the following schedule of tasks, milestones, and deliverable documents.

Project Schedule



PLEASE CONTACT US FOR MORE INFORMATION ON PARTICIPATION

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